



Recent Advances in Science in Western Australia

Earth Sciences

A multi-authored collection of papers, edited by S K Skwarko of the Geological Survey of Western Australia, reviews all fossils described from the Permian of Western Australia, nearly one thousand species belonging to 22 fossil groups. An introductory chapter briefly surveys Permian palaeogeography, palaeoclimate and stratigraphic correlation.

Skwarko S K 1993 Palaeontology of the Permian of Western Australia. Geological Survey of Western Australia Bulletin 136.

The Tumblagooda Sandstone, deposited dominantly by fluvial processes on a palaeoslope to the northwest, is described by N H Trewin, of the University of Aberdeen, as interbedded fluvial and aeolian sandstone and dune deposits in which winds blowing obliquely up the palaeoslope to the southeast reworked the sandy, unvegetated and unconsolidated surface. Similar mixed fluvial and aeolian environments are considered to have been frequent in a wide range of climatic regimes prior to the abundance of land plants.

Trewin N H 1993 Controls on fluvial deposition in mixed fluvial and aeolian facies within the Tumblagooda Sandstone (Late Silurian of Western Australia). *Sedimentary Geology* 85:387-400.

The several interacting factors described by K H Morgan that have shaped the palaeodrainage systems of the Yilgarn Craton include land form prior to the breakup of Gondwana, breakup from Cretaceous to early Cainozoic, northward migration of the craton, and a number of distinct climatic cycles. The existing palaeochannels that were incised during the Early Eocene contain sedimentary sequences related to depositional and erosional cycles from the Late Eocene to the present. Valuable mineral deposits resulting from hydrochemical reaction with sediments include gold, uranium, alunite and gypsum. The palaeochannels contain water resources and potentially valuable lignite and limestone.

Morgan K H 1993 Development, sedimentation and economic potential of palaeoriver systems of the Yilgarn Craton of Western Australia. *Sedimentary Geology* 85:637-656.

The abundance of the normally tropical foraminiferan *Marginopora vertebralis* in southern Australian waters is attributed by J H Cann, of the University of Western Australia, and J D A Clarke, of Western Mining Corporation, to the warm Leeuwin current. They suggest that the presence of *M. vertebralis* in Last Interglacial sediments in the Glanville Formation in northern Spencer Gulf indicates a greater ecological influence of the palaeo-Leeuwin current across the continental shelf of southern Australia during periods of global warming and correspondingly higher sea levels.

Cann J H & Clarke J D A 1993 The significance of *Marginopora vertebralis* (Foraminifera) in surficial sediments at Esperance, Western Australia, and in Last Interglacial sediments in northern Spencer Gulf, South Australia. *Marine Geology* 111:171-187.

J S Myers, of the Geological Survey of Western Australia, describes the West Australian Craton and its adjacent orogens that have a Precambrian history of repeated generation, dispersal and aggregation of continental crust. Major episodes of collision and aggregation that occurred at 2700-2600, 2000-1800, 1300-1100 and 700-600 Ma coincide with similar activity in other Precambrian crust, and may reflect the formation of Precambrian supercontinents.

Myers J S 1993 Precambrian history of the West Australian Craton and adjacent orogens. *Annual Review of Earth and Planetary Sciences* 21:453-485.

Life Sciences

A cladistic analysis by A G Kluge, of the University of Michigan, presents a monophyletic classification of pythonine snakes based on an evaluation of all of the available evidence, mainly anatomical. The analysis concludes that the earliest pythonine radiations occurred in the Australian region.

Kluge A G 1993 *Aspidites* and the phylogeny of pythonine snakes. Records of the Australian Museum, Supplement 19.

Measurement of diurnal and seasonal water relations by J Dodd (WA Department of Agriculture) and D T Bell (University of Western Australia) of *Banksia* woodland canopy and understorey species indicate variable responses to summer drought. Water use was greater for canopy species (61% of total). Most canopy and understorey species depend on soil-stored water, and use most water in early summer (understorey) or late summer (canopy).

Dodd J & Bell D T 1993 Water relations of the canopy species in a *Banksia* woodland, Swan Coastal Plain, Western Australia. *Australian Journal of Ecology* 18: 281-293.

Dodd J & Bell D T 1993 Water relations of understorey shrubs in a *Banksia* woodland, Swan Coastal Plain, Western Australia. *Australian Journal of Ecology* 18:295-305.

Using protein electrophoresis, L Christidis of the Victorian Museum and R Schodde of the CSIRO Division of Wildlife Ecology (Lyneham) distinguish three primary lineages of meliphagine honeyeaters, *Lichenostomus*, *Meliphaga* and *Xanthotis*. The evolutionary radiations of honeyeaters are related to Plio-Pleistocene environmental oscillations in Australia and New Guinea.

Christidis L & Schodde R 1993 Relationships and radiations in the meliphagine honeyeaters, *Meliphaga*, *Lichenostomus* and *Xanthotis* (Aves: Meliphagidae): protein evidence and its integration with morphology and ecogeography. *Australian Journal of Zoology* 41:292-316.

Reproductive studies of females of the critically-endangered western swamp tortoise, by G Kuchling and S D Bradshaw of the University of Western Australia, indicate that vitellogenesis begins during summer aestivation and continues during autumn and winter, similar to many other chelids, but the timing of ovulation, which occurs in late September after a feeding bout that greatly increases body mass, is different.

Kuchling G & Bradshaw S D 1993 Ovarian cycle and egg production of the western swamp tortoise *Pseudemydura umbrina* (Testudines: Chelidae) in the wild and in captivity. *Journal of Zoology, London* 229:405-419.

A comprehensive ecological survey of the Abydos-Woodstock Reserve by various members of the Western Australian Museum summarises the history and land-use, physiography and climate, geology and soils, vegetation and habitats, and the invertebrate and vertebrate fauna, and makes management recommendations.

Western Australian Museum 1991 Ecological survey of Abydos-Woodstock Reserve, Western Australia. Records of the Western Australian Museum, Supplement 37.

J B Hutchins and K N Smith, of the Western Australian Museum, present a comprehensive catalogue of the type specimens of fishes in the collection of the Western Australian Museum.

Hutchins J B & Smith K N 1991 A catalogue of type specimens of fishes in the Western Australian Museum. Records of the Western Australian Museum, Supplement 38.

Physical Sciences

Gas chromatographic-mass spectrophotometric analysis of weathered bitumens from coastal Western Australian locations by researchers at Curtin University of Technology indicate biomarkers such as bicadinanes, which are believed to be derived from a tropical angiosperm, and suggest that these bitumens may have been transported from South East Asia to Western Australia by the Leeuwin Current.

Currie T J, Alexander R & Kagi R I 1992 Coastal bitumens from Western Australia — long distance transport by ocean currents. *Organic Geochemistry* 18:595-601.

Polarised neutron diffraction (pnd) measurements made on the compound $[\text{Co}(\text{NH}_3)_5(\text{OH})_2][\text{Cr}(\text{CN})_6]$ by B N Figgis and E S Kucharski (University of Western Australia) and M Vrtis (Institut Laue-Langevin, France) surprisingly show that about one-third of the unpaired electrons arising from the chromium (III) anion are located on the cobalt atom and the amine protons of the cation.

Figgis B N, Kucharski E S & Vrtis M 1993 Spin and charge transfer through hydrogen bonding in $[\text{Co}(\text{NH}_3)_5(\text{OH})_2][\text{Cr}(\text{CN})_6]$. *Journal of the American Chemical Society* 115:176-181.

A model of the electric current distributions in electrochemical cells with parallel rectangular plates by researchers from the University of Western Australia, that does not make the usual assumption of one-dimensional flow, provides a more realistic estimation of the effects of electrode resistance and geometry in batteries.

Marshall S L & Wolff S K 1993 Calculation of ohmic resistance effects in rectangular electrodes of finite thickness. *Journal of Applied Electrochemistry* 23:443-451.

The measurement of the binding constants of alkali metal cations and the crown ether 18C6 by G Hefter of Murdoch University and M Salomon of the U. S. Army Power Sources Laboratory, in the solvent 2-cyanopyrimidine using conductance data, shows that the formation of these complexes and their electrical mobilities depend on the solvation of the complexed and uncomplexed cations. The observed behaviour has been related to that in other solvents of interest in high energy batteries.

Salomon M & Hefter G 1993 Mobilities of cation-macrocyclic ligand complexes. *Pure & Applied Chemistry* 65:1533-1540.

Calculation by I Bray (Flinders University) and A Stebovics (Murdoch university) of the total ionization cross-section and spin asymmetry for the electron-impact excitation of atomic hydrogen quantitatively agrees with experimental data, using previously developed convergent close-coupling formalism.

Bray I & Stebovics A T 1993 Calculation of the total ionization cross section and spin asymmetry in electron-hydrogen scattering from threshold to 500 eV. *Physical Review Letters* 70:746-749.

Note from the Hon Editor: This column helps to link the various disciplines and inform others of the broad spectrum of achievements of WA scientists (or others writing about WA).

Contributions to "Recent Advances in Science in Western Australia" are welcome, and may include papers that have caught your attention or that you believe may interest other scientists in Western Australia and abroad. Papers in refereed journals, or books, chapters and reviews will be accepted. Abstracts from conference proceedings will not be accepted. Please submit short (2-3 sentences) summaries of recent papers, together with a copy of the title, abstract and authors' names and addresses, to the Honorary Editor (c/o Western Australian Museum) or a member of the Publications Committee: Dr S D Hopper (Life Sciences), Dr A E Cockbain (Earth Sciences), and Assoc. Prof. G Hefter (Physical Sciences). Final choice of articles is at the discretion of the Hon Editor.

"Letters to the Editor" concerning scientific issues of relevance to this journal are also published at the discretion of the Hon Editor. Please submit a word processing disk with letters, and suggest potential reviewers or respondents to your letter. *P C Withers, Hon Editor, Journal of the Royal Society of WA*